DUSTFALL AND SNOW SAMPLING SURVEY

in the vicinity of

JAMES RIVER—MARATHON LIMITED
MARATHON, 1985–86

Ministry
of the
Environment
Ontario

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INTRODUCTION

James River-Marathon Limited operates a bleached kraft pulp mill about 400 m (metres) west of a residential area in the Town of Marathon. Before 1984, wood for the mill was stored as logs, and the logs were chipped in an enclosed area for immediate use at the mill. Since 1984, the company's wood supply has increasingly been in the form of wood chips, trucked in from several sources. The chips are dumped from the trucks into bins, then blown onto the tops of large storage piles located about 100 m north of a residential area. Wind-blown wood fibres from these piles have led to complaints from area residents.

In response to these complaints, the company established a monitoring network at four sites near the chip piles. To supplement the dustfall data, the Ministry conducted a snow sampling survey in January, 1986. This report present the results of the snow sampling study and summarizes dustfall measurements provided by the company.

METHODS

The locations of the company's dustfall monitoring stations from June, 1985 to May, 1986 are shown in Figure 1. Open-top containers (dustfall jars) were exposed for 30-day periods to collect fallout of particulate matter that settled out from the atmosphere by gravity.[1]

Single samples of snow were collected on January 30, 1986 from nine sites near the chip piles (Figure 2) and from two control sites remote from the study area. Core samples of the complete snow profile were obtained following standard Ministry sampling procedures.[2] Snow meltwater samples were submitted to the Ministry's Thunder Bay laboratory for determination of

calcium, chloride, sodium, sulphate, conductivity and pH. Analysis of carbon (dissolved inorganic carbon, dissolved organic carbon and total particulate carbon) and residues (dissolved solids, suspended solids and total solids) was performed at the Ministry's Toronto laboratory. Guidelines, developed by the Ministry for contaminants in snow, were used to assess the results of the survey. Insoluble particulate matter in selected samples of snow meltwater was examined with a dissecting microscope.

RESULTS AND DISCUSSION

Dustfall levels, reported in Table 1, exceeded the monthly provincial objective of 7 g/m^2/30 days about half the time at all sites. In the area of greatest concern near two apartment buildings (sites 2 and 3), the monthly objective was exceeded about 40 percent of the time. Site 4, farthest from the chip piles, was the only site where dustfall met the annual objective of 4.6 g/m^2/30 days. Microscopic examination of samples for June, 1985, showed that wood fibres accounted for up to 50 percent of the dustfall at site 1 (Figure 1) and for a significant portion of dustfall at the other three sites. In the company's measurements from June, 1985, to May, 1986, combustible matter (which would include wood fibres) comprised about half the total dustfall at all sites.

Results from the snow survey are summarized in Table 2. Levels of calcium, chloride, sodium and sulphate slightly or moderately exceeded Ministry contaminant guidelines at some sites, but were not excessive at any location. Emissions from the kraft mill complex and the application of road salt probably accounted for the recorded concentrations of these parameters. Conductivity values were normal. Meltwater pH was slightly above background at sites nearest to the chip piles.

Concentrations of particulate carbon and residues (solids) were significantly elevated near the chip piles and decreased as distance from the piles increased. Their distribution pattern was similar to that shown in Figure 3 for suspended solids. The guideline for suspended solids (30 mg/ℓ) was exceeded at all sampling locations and was in the 125 to 150 mg/ℓ range near the apartment buildings (sites 1 and 2, Figure 2) from which complaints originated.

Trace to moderate quantities of wood fines and black particulate matter (wood or bark char) were visible in snow at all sites except the controls. Microscopic examination determined that at sites 1 and 2 near the apartments, wood fibres accounted for 97-98% of the suspended solids. At the greatest distance sampled from the chip piles (sites 4 and 10) wood fibres still comprised 85-90% of suspended solids.

CONCLUSIONS

From May, 1985 to June 1986, dustfall around the wood chip piles near the James River-Marathon mill frequently exceeded provincial objectives. Significant fallout was restricted to a small area near the chip piles. Wood fines were probably a major component of the dustfall at the three sites nearest the mill. The snow sampling survey conducted in January, 1986 showed that the chip piles were significant sources of airborne wood fines. The results of this survey, plus statements from complainants and observations by Ministry staff, indicate that the fallout of wood fines near the chip piles caused a localized nuisance problem. Subsequent action by the company to reduce emissions from the chip piles may have resulted in some improvement since the date of the survey.

Ministry studies have shown that dustfall may be under-reported if wood fines are present.[3] This situation may arise if wood fines are too large to pass through a 20-mesh screen. The

standard method for dustfall analysis specifies a 20-mesh screen to trap and discard twigs, leaves, insects and other natural debris. Near wood-using industries, it may be advisable to examine this fraction of dustfall to determine if substances related to industrial activity are present. The Ministry has established two temporary dustfall monitoring sites near the company's sites 2 and 3. Insoluble dustfall from the Ministry sites, including the 20-mesh fraction, will be examined for evidence of wood-fines.

ACKNOWLEDGEMENT

We wish to thank James River-Marathon Limited for providing dustfall data from their monitoring network.

REFERENCES

1. Ontario Ministry of the Environment, 1984. Method for the sampling and determination of atmospheric dustfall. Report AMP-142. Air Resources Branch.

2. Ontario Ministry of the Environment, 1983. Field investigation procedures manual, Phytotoxicology Section, Air Resources Branch.

3. Griffin, H.D. 1986. Significance of the 20-mesh fraction of dustfall in northwestern Ontario, 1984. Ontario Ministry of the Environment.

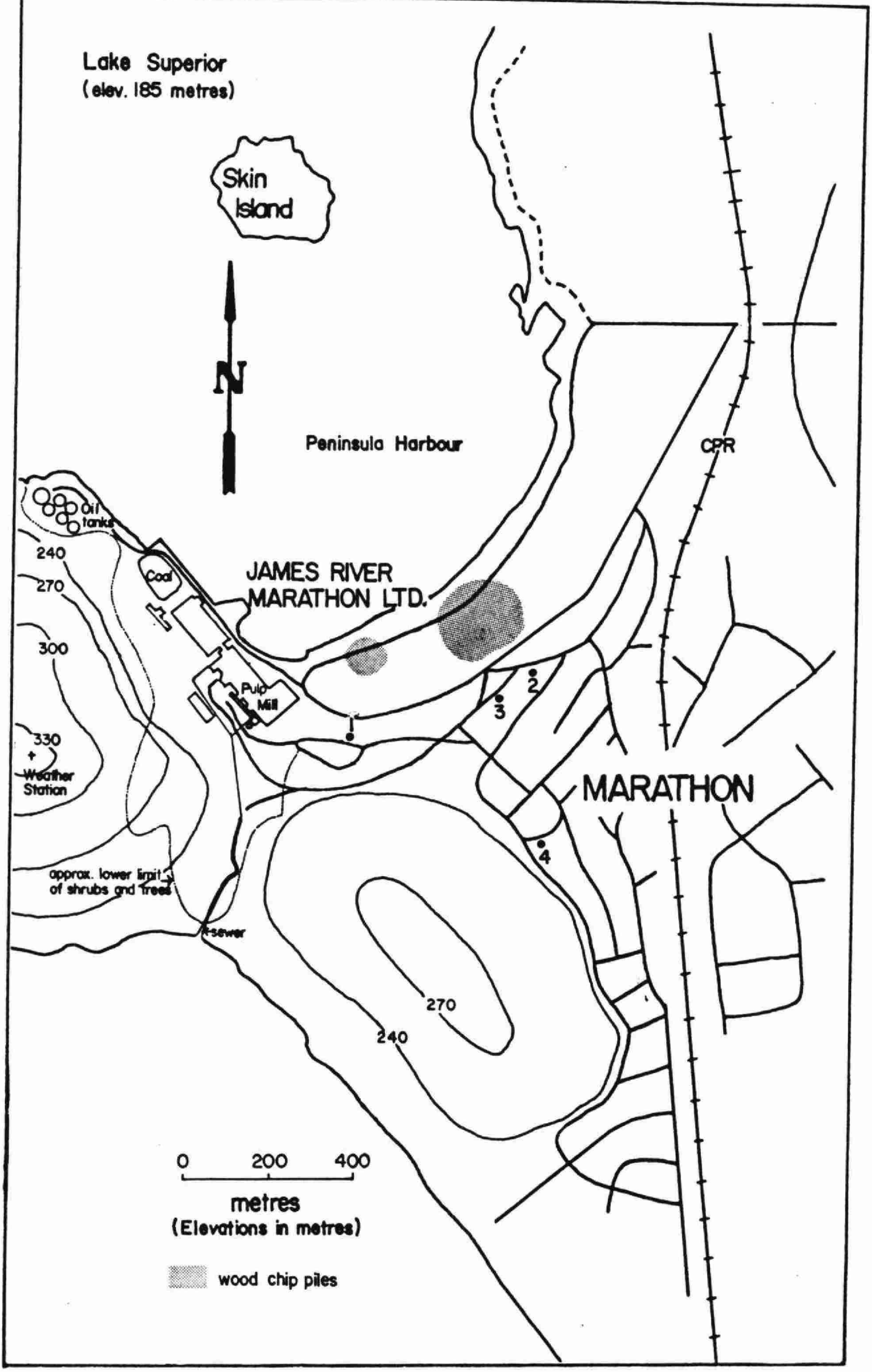

Figure I. Dustfall monitoring sites, Marathon, June 1985 to May 1986.

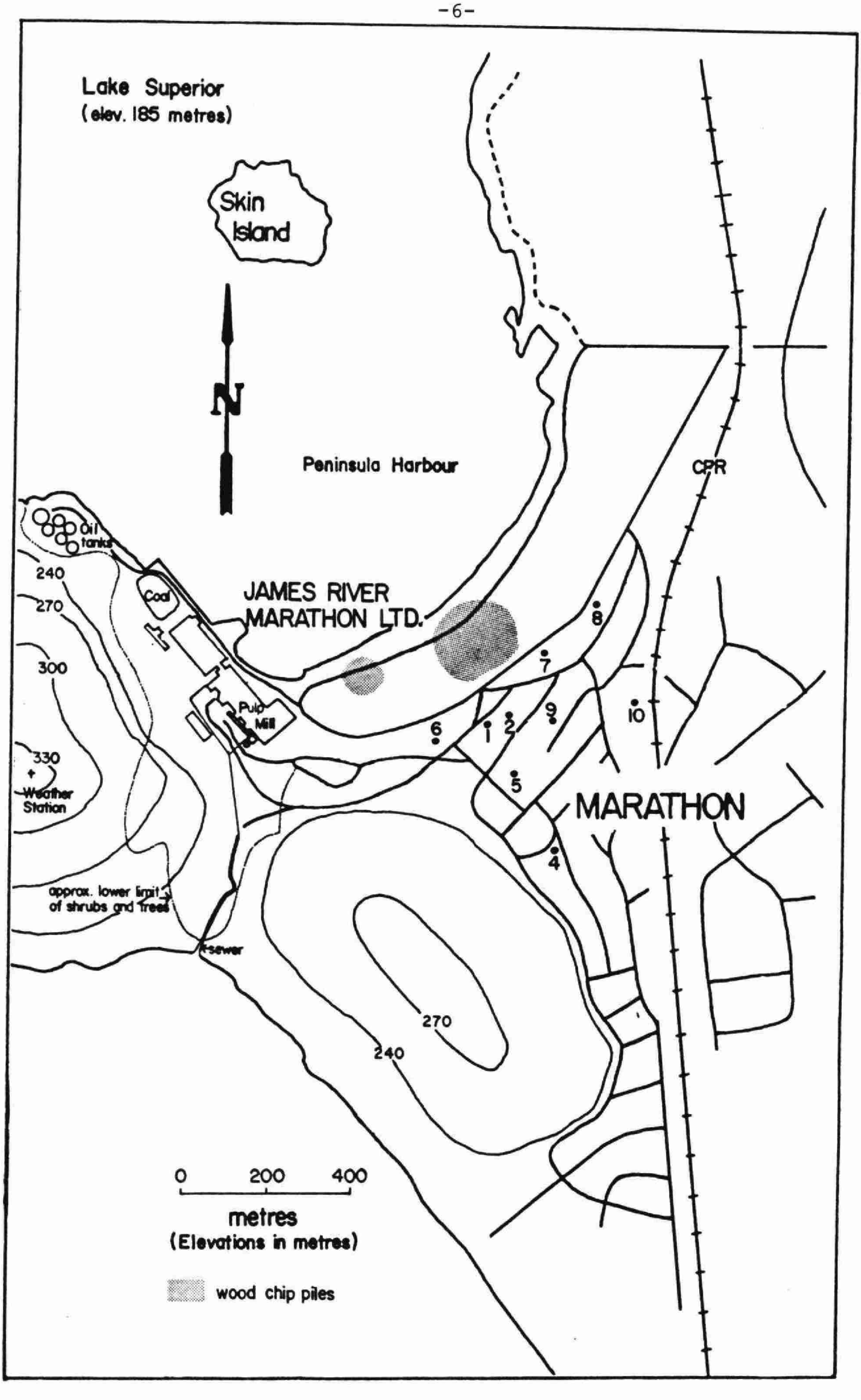

Figure 2. Snow sampling sites, Marathon, January, 1986.

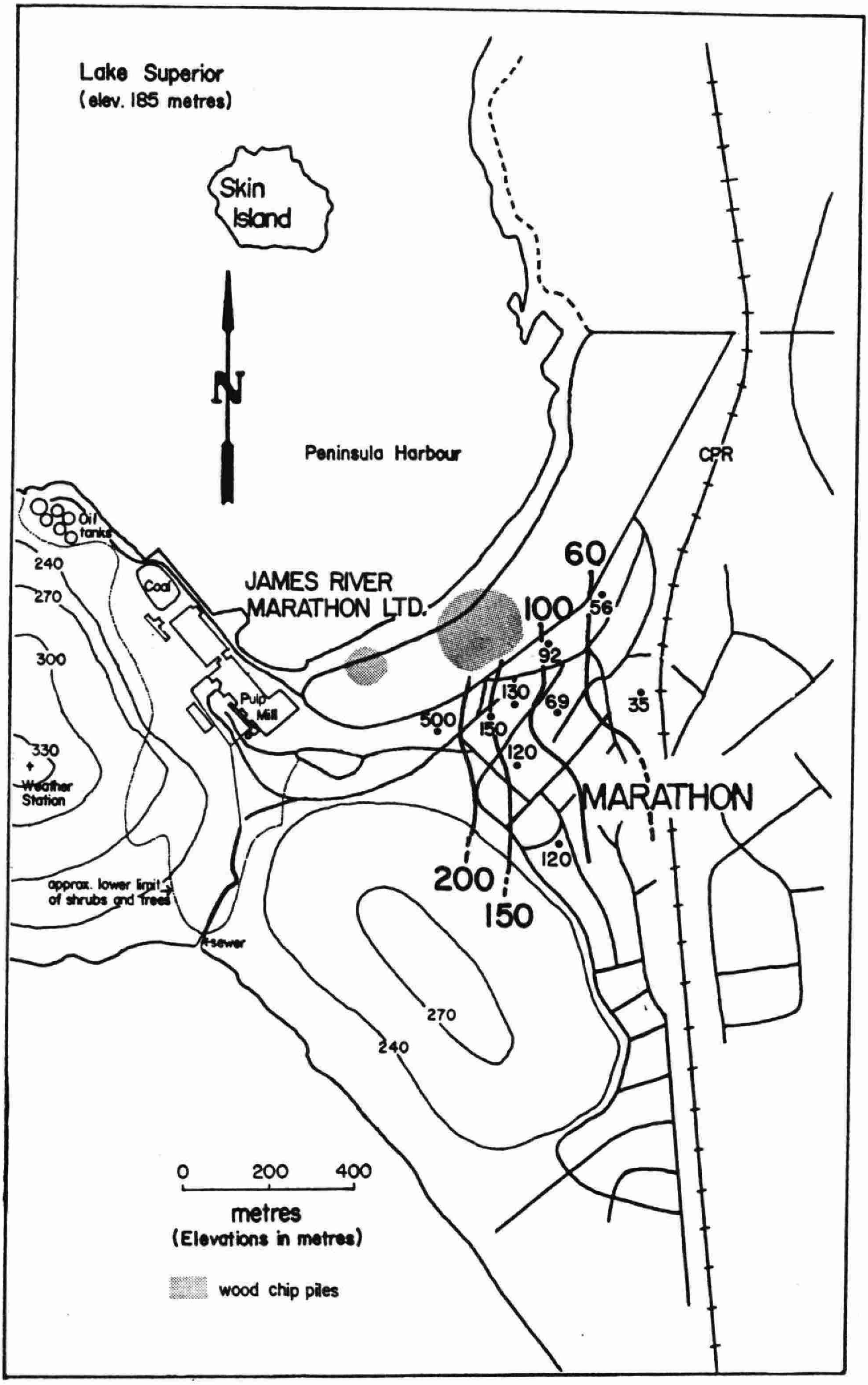

Figure 3. Levels of suspended solids (mg/l) in snow, Marathon, January, 1986.

TABLE 1. Total insoluble and combustible dustfall (g/m²/30 days) near the James-River Marathon Ltd. wood chip piles, June 1985 to May 1986.

Station	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Mean
							Total dustfall						
1	24.6[a]	5.1	11.4	10.5	20.0	6.7	14.4	9.9	8.1	17.7	20.8	8.4	13.1
2	10.7	4.9	12.5	6.8	9.5	2.7	1.8	4.6	2.0	5.1	8.7	7.4	6.4
3	8.8	4.3	9.2	8.0	10.0	2.5	2.7	4.0	2.9	5.8	12.1	7.8	6.5
4	6.8	2.1	3.4	3.9	5.6	3.4	4.1	2.9	1.6	5.5	8.0	4.2	4.3
							Insoluble dustfall						
1	7.6	-	7.2	7.4	9.4	5.4	12.1	6.0	4.5	9.4	7.5	4.3	7.4
2	8.4	-	10.8	4.9	7.4	2.2	1.4	2.7	1.9	4.7	6.7	4.6	5.1
3	5.7	-	7.8	6.1	8.2	1.8	2.4	2.3	2.8	4.9	8.3	4.8	5.0
4	4.4	-	2.8	3.4	3.9	2.4	3.1	1.2	1.5	3.8	4.2	2.3	3.0
							Combustible dustfall						
1	6.0	2.0	6.2	6.7	16.4	3.7	9.5	8.8	7.1	6.5	3.7	2.2	6.6
2	4.5	2.8	5.1	3.8	5.1	1.4	2.0	3.8	1.2	2.9	1.0	1.2	2.9
3	4.4	2.2	4.6	3.8	1.0	1.0	2.0	3.3	2.3	2.6	1.3	1.3	2.5
4	2.0	1.5	2.6	1.8	2.6	1.6	2.8	2.4	1.0	1.2	1.0	0.5	1.8

[a] Values exceeding maximum acceptable levels of 7.0 (monthly) or 4.6 (annual average) are underlined.

TABLE 2. Levels of calcium, chloride, sodium, sulphate, carbon, residues, conductivity, and pH in snow at Marathon, January, 1986. All values are in mg/ℓ except conductivity (μmhos/cm) and pH.

Station (Figure 2)	Ca	Cl	Na	SO_4	Carbon[a] DIC	Carbon[a] DOC	Carbon[a] PTC	Residues[b] RSF	Residues[b] RSP	Residues[b] RST	Cond.[c]	pH
1	2	3	4	7	1	3	80	35	150	190	38	6.2
2	1	3	3	4	<1	2	47	25	100	130	28	5.9
4	3	6	6	8	1	2	64	41	120	160	49	7.0
5	2	2	3	7	<1	3	71	27	120	150	34	6.0
6	3	5	4	5	2	9	230	45	500	540	42	5.7
7	1	3	3	4	<1	2	38	21	92	110	27	5.9
8	<1	2	2	2	<1	1	24	15	56	71	18	6.0
9	1	2	3	4	<1	2	35	17	69	82	23	5.5
10	<1	2	3	3	<1	<1	16	14	35	49	21	5.0
Controls	<1	<1	<1	1	<1	<1	8	9	15	24	10	5.0
Guidelines	2	4	2	3					30		60	

[a] Carbon: DIC = dissolved inorganic carbon, DOC = dissolved organic carbon, PTC = total particulate carbon.

[b] Residues: RSF = dissolved solids, RSP = suspended solids, RST = total solids.

[c] Cond.: Conductivity.